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Patent
Old Attorney's Docket No. 040071-245
New Attorney's Docket No. 0119-155

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	)	
	)	
Johan NILSSON et al.	)	Group Art Unit: 2631
	)	
Application No.: 09/996,513	)	Examiner: KUMAR, Pankaj
	)	
Filed: November 28, 2001	)	Confirmation No.: 3520
	)	
For: METHOD AND APPARATUS FOR CHANNEL ESTIMATION USING PLURAL CHANNELS	)	

RESPONSE

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The following remarks are presented as a complete response to the Office Action mailed on March 22, 2005.

Claims 1-11 remain pending in the application. Favorable reconsideration is respectfully requested in view of the following remarks.

The indication that claims 6-8 define allowable subject matter is noted with appreciation.

In numbered paragraph 1, the Office alleged that the information disclosure statement filed on March 21, 2003 fails to comply with 37 CFR §1.98(a)(1). Applicants respectfully disagree. The complete text of 37 CFR §1.98(a)(1) reads as follows:

> § 1.98 Content of information disclosure statement.
>
> (a) Any information disclosure statement filed under § 1.97 shall include:
>
> (1) A list of all patents, publications, applications, or other information submitted for consideration by the Office; ....

Contrary to the Office's assertion, no part of Rule 1.98 requires that an information disclosure statement include "(2) U. S. patents and U. S. patent application publications listed

in a section separately from citations of other documents; (3) the application number of the application in which the information disclosure statement is being submitted on each page of the list; (4) a column that provides a blank space next to each document to be considered, for the examiner's initials; and (5) a heading that clearly indicates that the list is an information disclosure statement."

Based on the above list of alleged requirements, the Office appears to be asserting that all information disclosure statements must be put on a PTO-1449, or its equivalent. Such an assertion would be incorrect. See, for example, MPEP §609 IIIC(2) at page 600-138 (Rev. 2, May 2004), which instructs how information disclosure statements should be handled: "If the citations are submitted on a list other than on a form PTO-1449 or PTO/SB/08A and 08B, the examiner may write 'all considered' and his or her initials to indicate that all citations have been considered. >For IFW processing, see IFW Manual section 3.< If any of the citations are considered, a copy of the submitted list, form PTO-1449, or PTO/SB/08A and 08B, as reviewed by the examiner, will be returned to the applicant with the next communication." (Emphasis added.) Clearly, the MPEP instructs examiners that information should be considered even when submitted in a form other than on a PTO-1449 or PTO/SB/08A and 08B.

The information disclosure statement filed on March 21, 2003 included all of the information necessary for the Office to consider the document submitted therewith, including a list of the one publication being provided ("Enclosed is a copy of an International Search Report prepared in the corresponding International application."), the application number of the application in which the information disclosure statement is being submitted (i.e., "09/996,513"), and a title clearly identifying the paper as an information disclosure statement (i.e., "Second Information Disclosure Statement"). Accordingly, it is believed to be in compliance with 37 CFR §1.98(a).

Numbered paragraph 2 of the Office Action alleges that the information disclosure statement filed on March 21, 2003 fails to comply with 37 CFR §1.98(a)(2), which requires a legible copy of each cited foreign patent document, each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed.

This allegation is not understood. The information disclosure statement filed on March 21, 2003 was accompanied by a copy of the one document cited therein, namely, the

International Search Report prepared in a corresponding International application. As to the documents listed in that search report, the information disclosure statement explained, "The documents cited in the report were included in the Information Disclosure Statement filed July 23, 2002, and are therefore not enclosed."

For the foregoing reasons, the information disclosure statement filed on March 21, 2003 is believed to have been in full compliance with 37 CFR §§1.98(a) and 1.98(b). Accordingly, Applicants do not believe that the information disclosure statement needs to be resubmitted. Instead, they respectfully request that the International Search Report submitted in that information disclosure statement be considered by the Examiner, and that he indicate that consideration in the next paper mailed out by the Office.

Claims 1, 4, 9, and 10 stand rejected under 35 USC §103(a) as allegedly being unpatentable over Strolle (USPN 6560299). This rejection is respectfully traversed.

As explained in the specification beginning at page 2, line 8, a base station most often transmits multiple physical channels. In TDMA systems, physical channels from the same base station are separated using time (and frequency if multiple carriers are used). In FDMA systems only frequency is used to separate different physical channels. In spread spectrum CDMA systems, codes are used to separate different users (and frequency if multiple carriers are used).

Regardless of the channel used, a received signal differs from the transmitted signal in various ways due to the effects of passing through the transmission medium. To recover (or "detect") the information symbols conveyed by the received signal, a receiver typically applies some form of baseband signal processing to the received sample stream. Such baseband signal processing may be based on a model of the transmission medium. The model is often expressed as estimates of filter channel coefficients.

Estimates of the channel tap coefficients can be determined by various channel tap estimation techniques. Accurate detection of the transmitted digital signal is dependent on having accurate estimates of the channel tap coefficients.

Each Base Station in a WCDMA system transmits on several physical channels. For several reasons, many of these physical channels contain pilot symbols that can be used to estimate channel properties. A pilot signal is typically one or more predetermined symbols that may be transmitted on its own channel or embedded in another channel and may be used for supervisory, control, equalization, continuity, synchronization, or reference purposes.

It is sought to derive an improved estimate of the channel tap coefficients by combining estimates generated independently from several physical channels. However, as explained in the specification beginning at page 11, line 7, the use of multiple received signals for estimating channel tap coefficients is complicated when the characteristics of the multiple received signals are too different. For example, errors occur when the received signals are derived from channels using different transmission powers, which is common in many modern communication systems. In a 3GPP system, dedicated and common channels are transmitted using different signals, which are often referred to as physical channels. The physical channels are separated by channelization codes and/or time-multiplexing. Depending on the configuration of the base station, these signals may, however, be transmitted through the same medium, thereby experiencing the same multipath. A DPCH and CPICH can be simultaneously received by a remote terminal, e.g., by different fingers of a rake receiver. The CPICH is broadcasted within each cell using a specific channelization code and always without power control. The power of the CPICH is chosen so that mobiles even outside the cell boundary can receive it. Thus, the power of the CPICH will in many cases be much higher than the power of DPCH's. Furthermore, the DPCH will in most cases be transmitted using power control, which is used to limit the power used by each individual DPCH to what is needed for each mobile to receive each DPCH. *Thus, the transmission powers on each DPCH and the CPICH will in most cases differ by an amount unknown to the mobile. We refer to this difference as the gain offset.* Note also that the gain offset will vary in time due to power control.

To address this problem, embodiments defined by claim 1 practice a "method of determining a gain offset between transmission channels in a communication system, comprising the steps of: deriving a first set of channel estimates from symbols received through a first channel; deriving a second set of channel estimates from symbols received through a second channel; and determining the gain offset based on the first and second sets of channel estimates." (Emphasis added.)

Embodiments defined by independent claim 4 practice a "method of determining a set of complex channel estimates for a transmission channel in a communication system, comprising the steps of: deriving a first set of channel estimates from symbols received through the transmission channel; deriving a second set of channel estimates from symbols received through a second channel in the communication system; determining a gain offset

based on the first and second sets of channel estimates; and determining the set of complex channel estimates based on the gain offset and the first and second sets of channel estimates." (Emphasis added.)

Embodiments defined by independent claim 9 practice a " method of determining a set of channel estimate gains for a transmission channel in a communication system, comprising the steps of: deriving a first set of channel estimates from symbols received through the transmission channel; deriving a second set of channel estimates from symbols received through a second channel in the communication system; determining a gain offset based on the first and second sets of channel estimates; determining a set of channel estimate gains based on the gain offset and the first and second sets of channel estimates; and associating the set of channel estimate gains with channel estimate phases of one of the first and second sets of channel estimates."

One aspect that all of these embodiments have in common is the derivation of first and second sets of channel estimates from symbols received respectively through first and second channels, and then using these first and second sets of channel estimates as the basis for determining the gain offset. As indicated above, knowledge of the gain offset can then be used by the receiver as a basis for effectively generating an improved estimate of the channel from the first and second channel estimates.

In order to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

The Office has failed to make out a *prima facie* case of obviousness for a number of reasons. First, the Strolle patent fails to disclose or suggest at least the claimed features identified above. That is, instead of generating first and second channel estimates and then "determining the gain offset based on the first and second sets of channel estimates" as required by Applicants' claims, Strolle discloses using a power estimator 402, 412 to

determine the respective gains of signals being processed by two receiver paths. In contrast to Applicants' variously claimed embodiments, Strolle does not use any channel estimate to determine gain. Instead, as explained in Strolle at column 8, lines 42-45, "a power estimator is a signal level sensing circuit, which provides a measure of the signal level (in this case, power) for comparison with a target reference level 402, 412." It is only after the gains are measured that Strolle's receiver is able to determine estimates of the two signal paths. This is apparent in Strolle at, for example: figure 1, which show the Front End A 18A and Front End B 18B being situated upstream of Equalizer A 24A and Equalizer B 24B, so that gain is determined prior to equalization parameters; and figure 4 which shows each of the power estimators 402, 412 receiving an input only from a respective one of the tuners, not from the equalizers 24A and 24B.

In support of its rejection, the Office argues that "power estimator 402 and gain A comprise estimates of channel A", and that "power estimator 412 and gain B comprise estimates of channel B." It is respectfully asserted that such statements have no technical merit. Neither the power estimator nor the gain associated with any receiver path comprises estimates of the physical channel. Rather, channel estimates must be calculated, and are typically based on some sort of comparison of a received signal containing known information (e.g., a pilot signal) with a theoretical ideal version of that signal. That comparison reveals how the channel has degraded the signal and sheds light on what channel tap coefficients would form a best model for that channel.

The Strolle patent recognizes the intense calculations required to generate a channel model when it states, at column 5, lines 41-62:

> By way of background review, it is known to use an equalizer to mitigate the signal corruption introduced by the communications channel. An equalizer is a filter that has the inverse characteristics of the communication channel. In situations where the communication channel is not characterized in advance, or changes with time, an adaptive equalizer is used. The variable parameters (filter coefficients) of the adaptive equalizer are calculated at the receiver. After the filter parameters are properly adjusted, the equalizer filter compensates for transmission channel distortion and noise. The problem to be solved in an adaptive equalizer is how to adjust the equalizer filter parameters in order to restore signal quality to a performance level that is acceptable by subsequent error correction decoding.
>
> A critical factor in an adaptive equalization system is to complete all the required multiplication operations within the time available: i.e., a single symbol interval. In particular, the calculation of filter parameters requires successive multiply operations for each equalizer parameter. Since a typical

> equalizer filter may have up to 512 filter coefficients (the number of equalizer filter parameters), the total time required to complete all the required multiplication operations with full precision often exceeds one symbol interval.

Nowhere does Strolle indicate that any equalization or channel modeling is performed within either of the power estimators 402, 412 nor would one of ordinary skill in this art consider the measured power of a received signal to be a channel estimate. And in any case, as explained above, Strolle expressly states at column 8, lines 42-45, that the power estimators 402, 412 operate simply by measuring the signal level. There is simply no basis for considering Strolle's power estimators to first generate first and second sets of channel estimates, and then to derive a gain offset based on the first and second sets of channel estimates.

The rejection is further deficient in that it fails to specify how or why the prior art would have motivated one of ordinary skill to modify the teachings of Strolle to include, for example, "determining the gain offset based on the first and second sets of channel estimates." Nor can any such motivation be found because the diversity receiver of Strolle is not faced with the problem that requires Applicants' solution.

In comparing Applicants' claimed embodiments with the teachings of Strolle, it is important to keep in mind that Applicants are addressing a problem that arises when two different signals are transmitted on different physical channels, and received by one antenna and one receiver. The transmitted signals carry different information relative to one another, and are transmitted at different power levels. The transmission powers on each of the two transmission channels will in most cases differ by an amount unknown to the mobile. This difference, which is referred to as the "gain offset," is the basis for the difficulty in combining the separately derived channel estimates into a single improved channel estimate. This is described in Applicants' specification at page 11, lines 7-27.

By contrast, Strolle is concerned with receiving the same transmitted signal through two antennas and two receiver chains (called "receiver channels" in Strolle, which is not the same as the "transmission channels" recited in independent claims 1, 4, and 9). There is no comparable "gain offset" to be computed in Strolle because there is only one transmission channel involved, which carries only one signal. It is the receiver's use of two physically separated antennas that makes diversity reception techniques (including two receiver chains) worthwhile in Strolle, but even within these two separate receiver chains there is no

uncertainty about a transmission power difference between the two signals because it is known that they originated as a single transmitted signal.

For at least the foregoing reasons, independent claims 1, 4, and 9 are believed to be patentably distinguishable over the Strolle patent. Claim 10, which depends from claim 9, inherits the features of that base claim and is patentably distinguishable over Strolle for at least the reasons set forth above. Therefore, it is respectfully requested that the rejection of claims 1, 4, and 9-10 under 35 USC §103(a) be withdrawn.

Claims 2, 3, and 11 stand rejected under 35 USC §103(a) as allegedly being unpatentable over Strolle in view of Choi (USPN 6754473). This rejection is respectfully traversed.

Claims 2 and 3 depend from independent claim 1, and claim 11 has independent claim 9 as its base claim. Because these dependent claims inherit the features of these independent claims they are patentably distinguishable over the Strolle patent for at least the same reasons as those set forth above.

The Choi patent fails to make up for the deficiencies of Strolle. The Office variously relies on Choi for its disclosures of pilot channels and of the WCDMA channels referred to in the art as DPCH and CPICH. However, Choi fails to disclose or suggest features such as deriving a first set of channel estimates from symbols received through a first channel; deriving a second set of channel estimates from symbols received through a second channel; and determining the gain offset based on the first and second sets of channel estimates, as required by Applicants' claims. Consequently, any combination of Strolle with Choi will still fail to include these features.

For at least the foregoing reasons, claims 2, 3, and 11 are believed to be patentably distinguishable over any combination of Strolle with Choi. Accordingly, it is respectfully requested that the rejection of these claims under 35 USC §103(a) be withdrawn.

Claim 5 stands rejected under 35 USC §103(a) as allegedly being unpatentable over Dufour (USPN 6700537). This rejection is respectfully traversed.

Claim 5 depends from independent claim 4, and is therefore patentably distinguishable over the Strolle patent for at least the same reasons as those set forth above with respect to claim 4.

The Dufour patent fails to make up for the deficiencies of Strolle at least because it fails to disclose or suggest such features as deriving a first set of channel estimates from

symbols received through a first channel; deriving a second set of channel estimates from symbols received through a second channel; and determining the gain offset based on the first and second sets of channel estimates, as required by Applicants' claims. Consequently, any combination of Strolle with Dufour will still fail to include these features.

Moreover, neither Strolle nor Dufour disclose determining the gain offset using a second-order equation, as defined by claim 5. In support of its rejection, the Office relies on Dufour for its alleged teaching that variance is proportional to the square of the difference in gain. However, determining a variance is not equivalent to determining a gain offset. Consequently, any combination of Strolle with Dufour will still fail to include the feature defined by claim 5.

The application is believed to be in condition for allowance. Prompt notice of same is respectfully requested.

Respectfully submitted,
Potomac Patent Group PLLC

Date: June 27, 2005

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